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EXPERIMENTS ON THE CONTROL OF THE PLUM CURCULIO, BROWN ROT, AND SCAB, ATTACKING THE PEACH IN GEORGIA

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INTRODUCTION

Perhaps the most severe infestation on record of the plum curculio (*Conotrachelus nenuphar* Hbst.) on the peach was experienced in Georgia in the season of 1920. Owing to the abundance and destructiveness of the insect that year, only a small proportion of the Georgia Belle and Elberta peaches could be marketed, the larvæ having rendered the greater part of them unmerchantable. Much of the fruit that was shipped in 1920 arrived at its destination greatly damaged by curculio larvæ, as in many cases wormy peaches were packed because the presence of the tiny larvæ just hatched could not be detected. It has been conservatively estimated that the curculio alone damaged the Georgia peach crop of 1920 to the extent of $2,000,000. The very heavy infestation of that year also provided innumerable punctures in the skins of the fruit, through which the brown-rot fungus, *Sclerotinia fructicola* (Wint.) Rehm,[2] gained easy access and frequently finished the work of destruction begun by the curculio. Since the peach crop of 1919 had also been a partial

[1] The authors are indebted for assistance to John B. Gill (1921) and W. D. Whitcomb (1921), of the Bureau of Entomology; Lee M. Hutchins (1921), of the Bureau of Plant Industry; and William F. Turner (1921–22) and Luther Brown (1923), of the Georgia State Board of Entomology, who have respectively helped to conduct the work during the seasons indicated.

[2] Other names which have been applied to this fungus are *Sclerotinia fructigena, S. cinerea, S. cinerea* forma *americana*, and *S. americana*.

failure owing to curculio and brown rot, a serious financial condition loomed up in the Georgia peach belt at the close of the 1920 season, which caused the growers to become greatly alarmed over the situation. For many years growers had kept their fruit practically free from these pests by spraying according to methods and schedules worked out and successfully put into practice by Quaintance (*3*),[3] Scott and Ayres (*5*), Scott and Quaintance (*6*), and Chase (*1, 2*). The losses of 1919 and 1920, however, showed that additional means of control were necessary, at least for the time being or until losses not more than normal again became the rule.

At the urgent request of the growers for assistance in solving the problem then threatening the Georgia peach industry, the Bureau of Entomology of the United States Department of Agriculture established, in the fall of 1920, a field station at Fort Valley, Ga., to undertake a study of the life history and control of the curculio. In the spring of 1921, when extensive experiments on spraying and dusting peaches were begun, the Georgia State Board of Entomology and the Federal Bureau of Plant Industry became cooperating agencies. The experiments were continued through four consecutive seasons at Fort Valley by the three cooperating organizations. The present publication is a report of the results obtained in each season, together with recommendations relating to spraying and dusting for the control of the curculio, brown rot, and scab,[4] in sections of the South where these pests, especially the two first named, are particularly destructive.

THE GEORGIA PEACH BELT

Central Georgia is one of the largest peach-growing regions in the United States. Within a radius of 40 miles of Fort Valley, said to be the largest peach-shipping station in the world, there are some 12,000,000 bearing and nonbearing peach trees.

The topography of the Georgia peach belt varies from generally level in the vicinity of Fort Valley to rolling in the more northern districts. The elevation varies from 350 to 800 feet above sea level. The altitude of Fort Valley is 526 feet.

The climate of this section is characterized by long, hot summers, during which the changes in temperature from day to day are very small, and by mild, brief winters. The normal annual temperature for the region is about 66° F. High temperatures continue during June, July, and August, and September is occasionally the hottest month in the year. The average annual rainfall in central Georgia is 48 inches (*9, p. 2*).

RELATIVE ABUNDANCE OF THE CURCULIO IN GEORGIA FROM 1920 TO 1924

Life-history studies of the curculio, which were conducted by the senior writer during each of the four years that the experiments on spraying and dusting were under way, show that two generations of the insect may occur annually in the latitude of central Georgia. Quaintance and Jenne (*4, p. 126*) also report the rearing of a second generation of the curculio at Barnesville, Ga., in the summer of 1910.

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[3] Reference is made by number (italic) to "Literature cited," p. 32.
[4] Caused by *Cladosporium carpophilum* Thüm.

The life-history studies of the senior writer in 1921 and 1922 showed that in those seasons two full generations of the curculio occurred in Georgia, and a large percentage of the "worms" in the fruit harvested late in the season in those years were larvæ of the second brood. In 1923 there was only one generation of the insect in central Georgia, whereas in 1924 there was a partial second generation. Marked variation in the yearly life cycle of the curculio in Georgia is therefore evident, and may be ascribed to seasonal climatic conditions.

Prior to 1921 the importance of the possible presence of a second generation of the curculio was not fully realized, and the schedules for spraying and dusting were formulated with control measures directed against only one brood of the insect. It had been an accepted fact that for practical purposes the curculio produced only one well-defined generation annually (*6, p. 20*). Another reason for not recommending additional applications of spray lay in the desire to minimize the risk of injury from them. In view of the fact that recent studies have emphasized the possibility and importance of the occurrence in Georgia of two generations of the curculio in some years, and since the severe infestation of the curculio in 1920 did not manifest itself to any great extent until the late varieties of peaches were ready to be harvested, one would suspect the presence of two generations in the season of 1920. The schedules for spraying and dusting in 1920 were based on a single brood of curculio per season, and a second brood would have no control measures directed against it. It is very probable that two broods of curculio larvæ occurred in each of several seasons prior to 1920; that in each case the second brood was allowed to work unchecked, and that as a result its progeny appeared in uncontrollable numbers in 1920, when weather conditions were especially favorable for the development of the insect. It is also quite probable that after years of success in the control of the curculio and brown rot, growers had become rather careless in the conduct of spraying operations.

In each of the four years the experiments in spraying and dusting were conducted on the Hiley and the Elberta, two of the varieties most commonly grown in Georgia. The relative abundance of the curculio in the Hiley orchards in these four seasons is very indicative of the gradual reduction of the general infestation in Georgia as a result of the vigorous campaign waged during the period for the suppression of the curculio. The Hiley variety is seldom attacked by the second-brood larvæ of the curculio in years when there are two generations of the insect. As a consequence, the difference in the number of broods annually does not cause any considerable fluctuation in the yearly infestation of the Hileys. It is only in years when there is a heavy second generation of the curculio in a season characterized by late blossoming that second-brood larvæ are found in the Hileys.

Because of the tremendous curculio population left in the orchards in 1920, when Georgia experienced the heaviest infestation of the curculio in the history of the peach industry, the infestation was heavier in the season of 1921 than in the three seasons which followed. Assuming the infestation of 1921 to be 100 per cent, the relative abundance of the curculio in the Hiley experimental orchards for

each of the years 1921 to 1924, inclusive, expressed as a percentage, was, respectively, 100, 61, 39, and 30.

The yearly infestation of the curculio in Elberta orchards will fluctuate with the variation year by year, influenced largely by climatic conditions, in the number of generations of the insect in the South. An explanation is found in the fact that when there are two broods of larvæ in a year the second brood will make its appearance in numbers at the time of the harvest of Elbertas. Thus, in 1921, 1922, and 1924, years in which there were two generations of the curculio in Georgia, the infestation was much heavier in the Elberta orchards than it was in 1923, when there was only one generation. A partial third generation of the insect was reared in the insectary in 1922. Again, assuming the severest infestation in any of the four years as 100 per cent, the relative abundance of the curculio in the Elberta experimental orchards for each of those years, taken in order and expressed as a percentage, was, respectively, 100, 99, 35, and 95.

CLIMATIC CONDITIONS AND CURCULIO BEHAVIOR

Climatic conditions have considerable influence on the development of the curculio and the severity of its infestations. It therefore may be of interest to tabulate the weather conditions that prevailed during the four seasons at the locality where the experiments were conducted, and to consider them in connection with the recorded activities of the curculio for the same seasons. Table 1 presents the mean temperature and the precipitation at Fort Valley for each of the nine months of February to October, inclusive, and the mean temperature and total precipitation for the duration of the nine months, in each of the four years of the experiments here reported. The "season" consisting of these nine months covers the entire range of the activity of the curculio in central Georgia. Of the four seasonal mean temperatures, that for 1921 was highest, and that for 1922 almost as high; these were the years in which two full generations of the curculio appeared.

TABLE 1.—*Precipitation and monthly mean temperatures, Fort Valley, Ga., February to October, 1921, 1922, 1923, and 1924 (8)*

Month	1921		1922		1923		1924	
	Mean temperature	Precipitation	Mean temperature	Precipitation	Mean temperature	Precipitation	Mean temperature	Precipitation
	°F.	*Inches*	°F.	*Inches*	°F.	*Inches*	°F.	*Inches*
February	51.4	2.77	56.9	4.67	49.4	3.87	47.3	5.15
March	64.9	1.10	58.0	9.73	57.8	7.51	52.6	3.37
April	64.4	3.10	68.0	2.63	64.4	3.27	63.5	4.79
May	71.0	3.80	72.5	5.90	69.5	9.71	69.8	3.94
June	81.2	2.91	80.0	3.74	76.3	5.99	80.4	4.93
July	80.0	8.24	80.6	5.95	79.7	2.64	80.0	6.18
August	79.8	4.31	78.8	4.28	80.8	5.00	82.6	1.39
September	82.4	1.80	77.2	2.63	77.0	2.83	71.7	11.25
October	64.8	2.21	66.5	2.91	65.3	.46	63.4	.81
Mean temperature for season	71.1		70.9		68.9		67.9	
Total precipitation for season		30.24		42.44		41.28		41.81

For 29 years, 1892 to 1920, the United States Weather Bureau has maintained climatological observations and records at Marshallville, Ga., 7 miles from Fort Valley, and, like the latter, in the heart of the Georgia peach belt. Data from the Marshallville records are therefore equally available for the purposes of these experiments, with the added advantage that the mean temperatures and precipitations for each month of the year, and for the year as a whole, derived from the records for the 29 years, afford satisfactory climatic data for use as normal or standard. In Table 2, therefore, are shown the mean temperature and the precipitation for each month of the year in each of the years 1921, 1922, 1923, and 1924, together with the means for each month, and for the year as a whole, derived from the observations for 29 years recorded at Marshallville.

The Marshallville data for the several months have been translated into graphical terms in Figures 1, 2, 3, and 4, there being one diagram for each of the four seasons covered by the study. The mean temperature and the total precipitation for each month is denoted by the location of a dot, as referred to the scale of temperature, at the left, and that of precipitation at the bottom of each graph. The dots denoting the 29-year means for the consecutive months are connected by a solid line, representing the normal values for the 12 months of the year, and this curve is shown without change in each figure. The dots for the consecutive months in each of the four years are connected by a broken line, each in its respective figure. With these curves the eye can readily compare each season with the others and with the normal.

TABLE 2.—*Precipitation and monthly mean temperatures, Marshallville, Ga.; means for 29 years, 1892 to 1920, and by months, for 1921, 1922, 1923, and 1924* (8)

Month	1892 to 1920		1921		1922		1923		1924	
	Mean temperature	Mean precipitation	Mean temperature	Mean precipitation	Mean temperature	Mean precipitation	Mean temperature	Mean precipitation	Mean temperature	Mean precipitation
	° F.	*Inches*	° F.	*Inches*	° F.	*Inches*	° F.	*Inches*	° F.	*Inches*
January	47.8	4.42	51.3	2.04	48.0	4.96	53.0	7.41	44.4	6.11
February	49.0	5.91	52.6	3.67	57.5	5.73	51.3	5.25	48.4	6.19
March	58.1	5.47	66.3	1.18	58.2	12.31	59.6	8.87	53.4	3.98
April	64.4	4.30	65.0	4.82	68.4	1.63	65.4	3.71	64.6	4.98
May	73.4	3.21	71.3	4.49	73.2	8.24	71.0	12.85	70.4	3.76
June	79.3	4.14	81.8	2.15	80.2	6.87	77.0	5.54	81.4	7.28
July	80.9	6.04	80.8	10.46	81.4	3.36	80.4	4.44	81.0	8.09
August	80.5	5.04	80.8	2.63	79.0	5.83	81.6	4.43	83.0	3.30
September	76.2	3.07	83.5	2.45	77.6	2.53	78.5	1.14	73.0	9.83
October	66.0	2.92	65.5	2.14	67.5	2.84	67.5	T.	63.6	.97
November	55.6	3.07	60.2	4.13	59.4	.82	54.1	2.78	57.2	1.23
December	48.1	4.44	53.8	1.76	56.0	7.11	56.8	3.69	52.0	7.71
Mean temperature for year	-------	-------	67.7	-------	67.2	-------	66.4	-------	64.4	-------
Total precipitation	-------	-------	-------	41.92	-------	62.23	-------	60.11	-------	63.43

It may be seen from Table 2 and Figure 1 that the spring of 1921 was warmer than the normal spring, with less than normal precipitation. In the Georgia peach belt these conditions, especially during the month of March, promote the early emergence of the adult curculios from hibernation. When the curculio gets an early start

in the spring, and when weather conditions are favorable for pupation during May, June, and July, two generations of the insect will usually occur. The pupation of the insect is greatly facilitated by damp soil and high temperatures; the precipitation in May and July, 1921, was greater than normal, and the temperature for June was higher than normal. Two generations of the insect occurred in 1921, as a result of these conditions. The abnormal precipitation for July, 1921, more than 10 inches, is reflected in the very heavy infection of brown rot in the experimental orchard of Elberta peaches.

In 1922 there were again two generations of the curculio in central Georgia, and it may be seen from Table 2 and Figure 2 that the temperature in February of that year was considerably above normal. In this region a warm February has a tendency to bring the curculio out of hibernation earlier than usual, even though the temperature is normal during March, the month when a majority of the beetles appear. In May and June the precipitation was much greater than

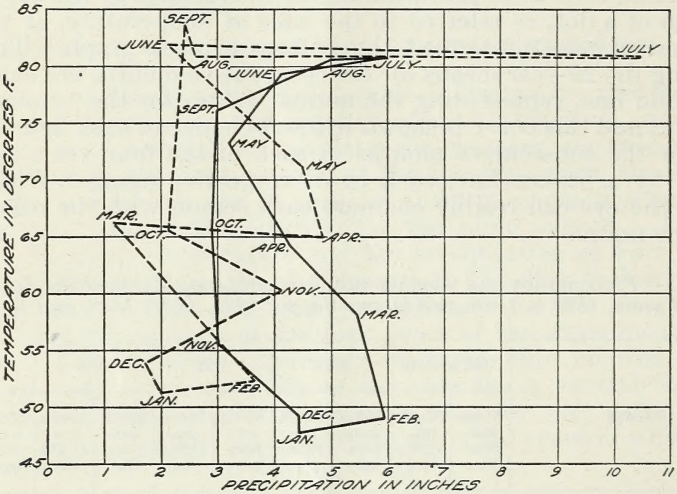

FIG. 1.—Comparison of normal monthly precipitation and temperature at Marshallville, Ga., for 29 years, with precipitation and mean temperature by months for the year 1921. Points indicating normal data are connected by a solid line; those indicating data for 1921 by a broken line

normal, tending to hasten the development of first-generation adults in time to produce a second generation. The heavy precipitation for May and June is reflected in the scab infection of 1922. There was also a moderate infection of brown rot in the same year.

In 1923 there was but one generation of the curculio. A cool, wet spring so prolongs the hibernation of adult curculios that they do not have sufficient time to produce a second generation before the peach crop is harvested. Figure 3 and Table 2 show a precipitation much above the normal for the first half of that year. Temperatures were about normal. The heavy precipitation in May is reflected in the heavy scab infections in 1923 in the experimental orchards of Hiley and Elberta peaches.

A small second generation of the curculio occurred in 1924. Weather conditions during the period when the insects usually leave hibernation were not very favorable for their early appearance in

orchards. Temperatures were unusually low; the precipitation for March, however, was below normal. (Fig. 4.) Although the insect did not leave hibernation especially early in 1924, weather conditions

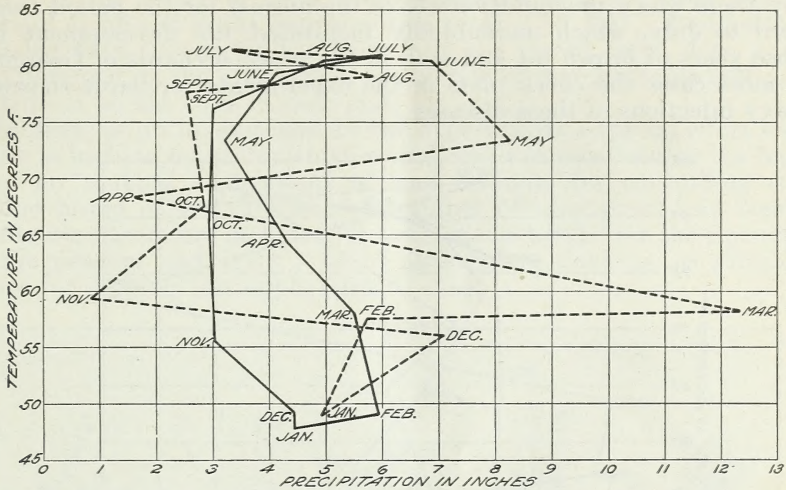

FIG. 2.—Comparison of normal monthly precipitation and temperature at Marshallville, Ga., for 29 years with precipitation and mean temperature by months for the year 1922. Points indicating normal data are connected by a solid line; those indicating data for 1922 by a broken line

during May, June, and July were so favorable for the pupation of the insect that the development of first-generation adults was hastened, and a small second generation was produced; the precipitation for

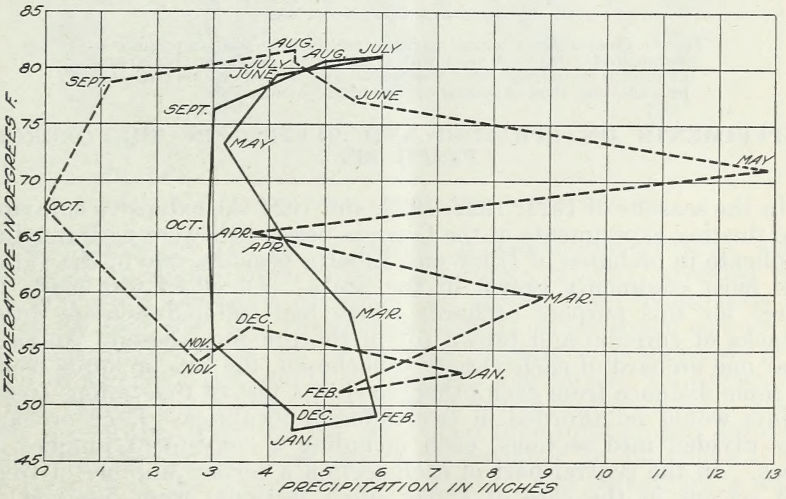

FIG. 3.—Comparison of normal monthly precipitation and temperature at Marshallville, Ga., for 29 years, with precipitation and mean temperature by months for the year 1923. Points indicating normal data are connected by a solid line; those indicating data for 1923 by a broken line

these months was higher than normal, and the temperatures higher than usual in June and July. The abnormally high precipitation in the early summer of 1924 is reflected in the heavy scab infection in the

experimental orchards of the Hiley and Elberta peaches and the moderately heavy brown rot infection in the Elberta orchard.

In each of the four years that this experimental work was under way there was a precipitation above the normal for the period from April to July, which undoubtedly facilitated the development in those years of brown rot and scab in the peach orchards of Georgia. In most cases the check plats in the experimental orchards showed heavy infections of these diseases.

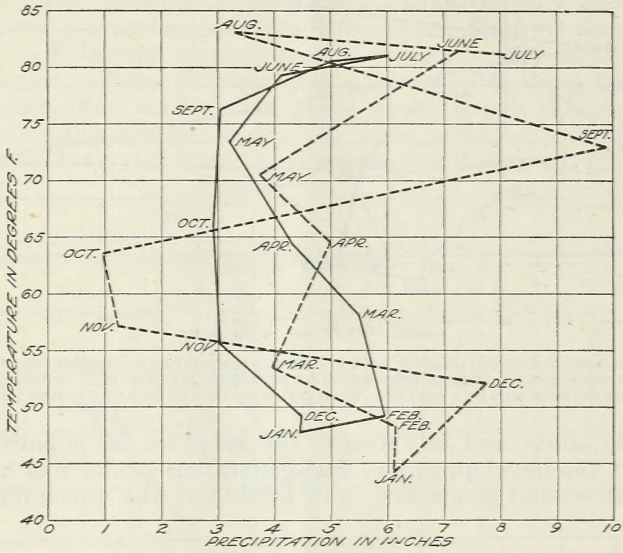

FIG. 4.—Comparison of normal monthly precipitation and temperature at Marshallville, Ga., for 29 years, with precipitation and mean temperature by months for the year 1924. Points indicating normal data are connected by a solid line; those indicating data for 1924 by a broken line

EXPERIMENTS ON SPRAYING AND DUSTING IN THE GEORGIA PEACH BELT

In the seasons of 1921, 1922, 1923, and 1924 the extensive spraying and dusting experiments in the Georgia peach belt were performed in duplicate in orchards of Hiley and Elberta peaches, two of the varieties most commonly grown in the State. An effort was made to select for this purpose orchards which had suffered severely from attacks of curculio and brown rot in the previous season. In each year one orchard of each variety was chosen, the two orchards being at some distance from each other, so that a test of the various treatments would be afforded in two different localities. Each orchard was divided into sections, each including a convenient number of trees. In the central part of each section a certain number of trees (10, except in the case of a few small sections) were reserved as "record" trees, the fruit from which was harvested separately, including the fruit picked and that dropped from the tree during and just before the harvest season. Each record tree was designated by a white cloth band or tape encircling the tree and resting on the outer limbs. Each peach was cut open, examined, and recorded, so that the exact percentages of sound fruit from these trees and of fruit

injured by the curculio, brown rot, and scab could be ascertained. Throughout the season all dropped fruit under the record trees was collected and examined to determine the extent of curculio infestation. In the season of 1922, 110,648 peaches were cut open in one orchard alone and in the four seasons a total of 551,361. Besides the detailed data concerning the fruit from the record trees, data were also obtained on the commercial production of merchantable and cull fruit from all the trees in each plat.

In drawing up the outlines for the experiments a special effort was made to include schedules which would result in ascertaining the best time for making applications of lead arsenate for controlling the second brood of the curculio. A number of arsenate-of-lead treatments were therefore included for tests one month before the ripening of the peaches and again 7 to 10 days before ripening, as suitable times for making this application.

FIG. 5.—Peach blossoms, showing curculio feeding marks on the calyces

Observations by the senior author in Mississippi in 1920, substantiated by similar observations in Georgia in 1921, revealed the fact that when the adult curculios first appear from hibernation in the spring they feed to a considerable extent on the green calyces of the peach flower. (Fig. 5.) A number of plats were therefore provided to ascertain the results of poisoning the calyces with arsenate of lead before the beetles visited them for their first meal. Plats were also provided for testing self-boiled lime-sulphur and sulphur dust, respectively, one week before the ripening, to determine their effectiveness in the prevention of brown rot; and several plats were included to compare the efficiency of the spray with that of the dust.

EXPERIMENTS IN 1921

An account of the 1921 experiments, including results obtained and a detailed discussion of the data, has already been published by the Department of Agriculture as Department Circular 216 (7). A dis-

cussion of the data for 1921 will not be repeated in this publication but the results will be referred to in deriving conclusions.

EXPERIMENTS IN 1922

In planning the experiments in spraying and dusting for the season of 1922, special attention was given to plats which should receive an application of arsenate of lead when 75 per cent of the petals had fallen and another application four weeks before the fruit ripened, besides other more usual applications. The two applications were intended for continuing the tests of the early treatment with arsenate of lead as a preventive of curculio infestations in the young fruits, and tests of the late arsenical treatment as a protection of the ripening peaches from the second brood of larvæ. Schedules were also included for testing the comparative effectiveness of the sprays and dusts. A combination of sulphur, lime, and calcium caseinate, the ingredients of which are mixed together dry before adding water, was tested on one plat for effectiveness against brown rot and scab. To test the possible usefulness of a "sticker," or "spreader," a plat was provided which received the same treatment as the standard plat, except that in each application calcium caseinate was added to the spray. Table 3 gives an outline of the experiments planned for the season of 1922.

TABLE 3.—*Outline of experiments in spraying and dusting peach trees, for the season of 1922, Fort Valley, Ga.*

Plat	Time of application				
	As petals fall	When calyces are shedding	Two weeks after shedding of calyces	Four weeks before harvest	Just before picking
I	A. L. L.	A. L.-L.	A. L.-S. B.	A. L.-S. B.	
II	A. L. L. C.	A. L.-L.-C.	A. L.-S. B.-C.	A. L.-S. B.-C.	
III		A. L.-L.	A. L.-S. B.	S. B.	
IV	A. L. L.	A. L.-L.	A. L.-S. B.	A. L.-S. B.	80–20 dust
V	A. L. L.	A. L.-L.	A. L.-S.	A. L.-S.	
VI	80–5–15	80–5–15	80–5–15	80–5–15	
VII [1]					

[1] Check plat; not treated.

A. L.=Arsenate of lead powder, 1 pound to 50 gallons of spray.
L.=Milk of lime, made from 3 pounds of stone lime per 50 gallons of spray.
C.=Calcium caseinate, 6 ounces to 50 gallons of spray.
S. B.=Self-boiled lime-sulphur mixture, 8–8–50.
S.=Sulphur 6 pounds, hydrated lime 4 pounds, and calcium caseinate 8 ounces, per 50 gallons spray. (Sulphur, lime, and calcium caseinate were mixed dry and then the water was added.)
80–5–15=Dust; sulphur, 80 per cent; arsenate of lead, 5 per cent; lime, 15 per cent.

As in 1921, the experiments were performed on trees of the varieties Hiley and Elberta. Both orchards were practically level and had a sandy loam soil. The crop that matured in the Elberta experimental orchard, however, was so light that the results from it are not reliable, and only the results of the experiments with the Hiley peaches will be given. From 500 to 1,000 fruits should be harvested from each record tree for reliable results from spraying or dusting. An average of only 54.7 fruits per tree were harvested from the Elberta record trees in 1922.

The orchard was divided, as in 1921, into plats of as nearly equal size as practicable. Each plat consisted of about 150 trees, except the check plat, which was in two parts, in opposite corners of the

orchard, and contained in all 70 trees. An effort was made to place all plats at equal distance from the hibernating quarters of the curculio. (Fig. 6.)

The applications of dust were made with large power dusting machines and the liquid was applied with power sprayers, developing from 250 to 275 pounds pressure. The spraying and dusting were done only when favorable weather conditions prevailed. These and all other operations in the present research were performed by the parties named as writers of this bulletin.

In Tables 4, 5, and 6 the results of the experiments in spraying and dusting conducted on the Hiley peach trees in the season of 1922 are

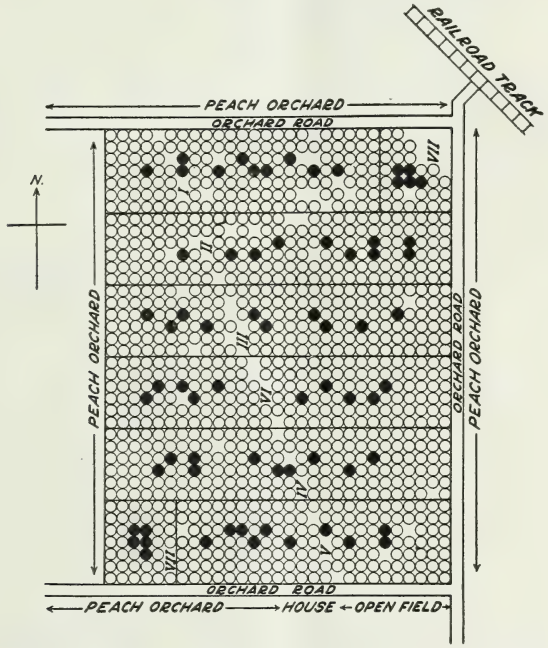

FIG. 6.—Diagram of orchard of Hiley peaches used for experiments in the season of 1922. Each tree is represented by a circle, the solid black circles representing record trees

given in terms of percentages. Table 4 presents the results obtained from the examination of the fruit from the record trees of each plat at harvest time, besides which the last two columns give the percentages of merchantable and cull fruit harvested from those trees, as determined by grading the fruit before it was cut open for examination. In Table 5 are the numbers of fruit that dropped to the ground from the record trees in the different plats from shortly after the pollination season until the fruit was ready to be harvested, and the percentage of curculio-wormy fruit in each. Table 6 gives the commercial results of fruit from all trees in each plat.

TABLE 4.—*Summary of results of experiments in peach dusting and spraying at Fort Valley, Ga., in 1922; fruit harvested from record trees of the Hiley variety*

Plat	Total number of fruit	Percentage of total fruit having—												Percentage of total fruit found to be sound	Percentage of total fruit as graded before being opened for examination	
		Curculio larvæ	Brown rot	Scab	Curculio larvæ only	Brown rot only	Scab only	Curculio larvæ and—			Brown rot and scab	Brown-rot infection at curculio puncture	Scab and brown-rot infection at curculio puncture		Merchantable fruit	Cull fruit
								Brown rot and scab	Brown rot	Scab						
I	8,107	1.8	1.1	0.8	1.6	0.9	0.8					0.2		96.5	79.9	[1] 20.1
II	9,727	3.4	.6	.8	3.2	.5	.7			0.1		.1		95.4	82.6	17.4
III	9,433	17.0	4.9	.5	15.3	3.3	.4		0.1	.1		1.5		79.3	76.4	23.6
IV	11,620	3.4	.9	.8	3.1	.7	.7			.1		.2		95.2	85.1	14.9
V	8,685	4.2	1.1	.3	3.9	.8	.3					.3		94.7	74.7	[1] 25.3
VI	9,782	11.3	5.2	.9	9.4	3.3	.9					1.9		84.5	81.7	18.3
VII [2]	8,180	22.9	32.0	64.9	3.6	11.3	42.7	0.2	.3	7.8	9.2	6.0	5.0	13.9	50.0	50.0

[1] Some fruits on these plats were small, hence the high percentage of culls.
[2] Check plat; not sprayed or dusted.

TABLE 5.—*Number of peaches dropping from Hiley peach trees, and percentage of them infested by curculio, in experimental orchards at Fort Valley, Ga., season of 1922*

Plat	Total number of drops	Total percentage of drops infested by curculio
I	5,160	11.8
II	5,207	15.2
III	7,264	25.7
IV	7,669	12.4
V	3,840	17.0
VI	7,869	28.4
VII	8,105	43.1

TABLE 6.—*Commercial results of fruit from all trees in each plat of the Hiley variety, used in the peach spraying and dusting experiments, Fort Valley, Ga., 1922*

Plat	Number of trees in plat	Average merchantable fruit per tree (expressed in cups; six cups equal one crate)	Average cull fruit per tree (expressed in cups; six cups equal one crate)
I	147	[1] 13.5	3.4
II	164	17.1	3.6
III	165	15.2	4.7
IV	168	21.7	3.8
V	154	[2] 13.0	4.4
VI	168	18.7	4.2
VII	[3] 70	8.1	8.1

[1] Some of this fruit was small. Much sound fruit was graded as culls on account of size.
[2] Fruit very small on account of serious foliage burn.
[3] In two portions, in opposite corners of the orchard.

A study of Table 4 shows that there was a moderate infection of brown rot and, for central Georgia, a heavy infection of scab. There was a moderately heavy infestation of curculio, although this infestation in the untreated or check plat was not so heavy as in that of 1921. Of the fruit from the check plat, 22.9 per cent was infested with the curculio; 32 per cent showed brown-rot infection, and 64.9 per cent infection with scab.

To determine the effect of early spraying on the control of the curculio all of the small peaches that drop to the ground before maturity must be examined, as the early applications of arsenate of lead are directed especially against injury by the curculio to the small peaches. The efficiency of an early application of arsenate of lead as a killer of adult curculios, as they appear from hibernation and before they have had an opportunity to deposit eggs, was again clearly demonstrated in the work of this year. Table 5 shows that of the "drops" from plat III, which did not receive the early arsenate-of-lead treatment, 25.7 per cent were infested with curculio, whereas the percentages of infestation in the four plats (I, II, IV, and V) which received the early treatment averaged but 14. According to these results the application of arsenate of lead when 75 per cent of the petals had fallen reduced the number of curculio-infested fruits nearly 50 per cent. A reduction of the amount of curculio infestation in the "drops" correspondingly reduced the size of the second brood of larvæ which may attack the peaches later in the season.

The value of an application of arsenate of lead four weeks before the fruit is due to ripen, for the control of overwintered females which may deposit eggs throughout the fruit growing season, or for the control of a second brood of curculio, is shown in Table 4, which contains the data on the harvested fruit alone. Of the fruit harvested from the record trees on Plat III, which did not receive the late arsenate-of-lead treatment, 17 per cent was infested with curculio, whereas the percentages of infestation in the fruit harvested from Plats I, II, IV, and V, which received the late sprays for the control of the second brood of "worms," averaged only 3.2.

The close interrelation between curculio injury and brown-rot infection is indicated in Table 4. Plat III was found to have a curculio infestation of 17 per cent and a brown-rot infection of 4.9 per cent. Plats I, II, IV, and V, the several curculio infestations of which average 3.2 per cent, have an average of brown-rot infections of only 0.9 per cent.

As in 1921, the spray was superior to the dust for the control of curculio. Apparently there was also a somewhat better control of brown rot from the use of the spray than from dusting, although the differences between the two methods of brown-rot control are not great and are probably to be attributed to a greater curculio infestation in the dusted plat. In Plat VI, the dusted plat, 11.3 per cent of the fruit was infested with curculio and 5.2 per cent was infected with brown rot, as compared with a curculio infestation of 1.8 per cent and a brown-rot infection of 1.1 per cent in Plat I (Table 4), the plat which received the sprays at the same time that Plat VI received the dust applications.

The addition of calcium caseinate to the sprays (Plat II) to increase their sticking and spreading qualities did not appreciably increase the

efficiency of either the insecticide or the fungicide. The fruit harvested from Plat II (Table 4) was found to have a curculio infestation of 3.4 per cent and a brown-rot infection of 0.6 per cent, as compared with a curculio infestation of 1.8 per cent and a brown-rot infection of 1.1 per cent for Plat I (Table 4). Plats I and II were sprayed at the same times and with the same materials, except that calcium caseinate was added to each application for Plat II.

The sulphur, lime, and calcium caseinate used in Plat V controlled brown rot and scab, but the burning of the foliage from the use of this fungicide in combination with arsenate of lead was so severe that the size and flavor of the fruit were affected. The trees were entirely defoliated by September, more than a month before they would normally have shed their leaves, and this injury seems to have affected the vitality of the fruit buds for the succeeding year, as revealed by the size of the crop on these trees in 1923. Because of risk of severe injury, the mixture of sulphur, lime, and calcium caseinate tested this year could not be recommended for use in Georgia against brown rot and scab, at least when used with arsenate of lead. As shown in Table 4, the percentage of harvested fruit affected with brown rot was much less in all the treated plats than in the check plat; the percentage of rotted fruits averaged somewhat lower in the sprayed plats than in the dusted plat. The late application of dust in Plat IV, which had previously received two applications of self-boiled lime-sulphur at the regular times, made no appreciable difference in the control of brown rot. The dropping of fruit before harvest time is not considered in the brown-rot data, as the counts showed that very little brown rot developed until the fruit was ready for harvest.

Scab was well controlled by all of the fungicides used in the experimental work for 1922. Table 4 shows that the scab infection of the fruit harvested from all sprayed and dusted plats was less than 1 per cent. The infection of scab was 64.9 per cent on the fruit harvested from the record trees in the check, or untreated, plat.

Table 6 shows that when the fruit from Plat VII was graded 50 per cent of it was thrown into the culls. Furthermore, these untreated trees matured an average of only 1⅓ crates of merchantable fruit per tree, as compared with an average of from 2⅙ to 3⅔ crates for the trees in the plats that were sprayed or dusted.

EXPERIMENTS IN 1923

Since the experiments in 1921 and 1922 had shown the treatment with arsenate of lead four weeks before the ripening of the fruit to be of importance in the control of the curculio, it was decided without further experimentation to incorporate it in the regular schedule. The testing of the early treatment for the poisoning of adult curculios directly after their emergence from hibernation was continued. The effectiveness of four applications of a spray containing three-fourths of a pound of arsenate of lead to each 50 gallons of spray was compared with three applications of spray containing 1 pound of arsenate of lead to each 50 gallons. Tests as to the desirability of adding calcium caseinate as a "sticker" or "spreader" were continued, and two different formulas of the spray containing sulphur, lime, and calcium caseinate were tested for control of brown rot and scab. These formulas were thought to be an improvement on the formula

used in 1922, and were supposed to be safer, since they contained a large excess of lime to reduce the danger of injury from the combination of arsenate of lead and sulphur. Three applications of self-boiled lime-sulphur were compared with two applications of these mixtures for brown-rot and scab control. The testing of the comparative effectiveness of dusting and spraying was continued. Two formulas for dusting, with different percentages of sulphur, were tested for effectiveness against brown rot and scab.

Table 7 gives in outline the schedules used in the experiments in 1923.

TABLE 7.—*Outline of experiments in spraying and dusting peach trees, for the season of 1923, Fort Valley, Ga.*

Plat	Time of application			
	As petals fall	When calyces are shedding	Two weeks after shedding of calyces	Four weeks before harvest
I	A. L.–L.	A. L.–L.	S. B.	A. L.–S. B.
II	A. L.–L.–C.	A. L.–L.–C.	C.–S. B.	A. L.–C.–S. B.
III	A. L. 3–L. 3.	A. L. 3–S. B.	A. L. 3–S. B.	A. L. 3–S. B.
IV		A. L.–L.	S. B.	A. L.–S. B.
V		A. L.–L.	A. L.–S.	A. L.–S.
VI	0–5–95.	0–5–95.	80–5–15.	80–5–15.
VII	0–5–95.	0–5–95.	50–5–45.	50–5–45.
VIII [1]				
IX		A. L.–L.	A. L.–S. 1.	A. L.–S. 1.

[1] Check plat; not treated.

A. L. = Arsenate of lead powder, 1 pound to 50 gallons of spray.
A. L. 3 = Arsenate of lead powder, ¾ pound to 50 gallons of spray.
L. = Milk of lime, made from 3 pounds of stone lime per 50 gallons of spray.
L. 3 = Milk of lime, made from 2¼ pounds of stone lime per 50 gallons of spray.
C. = Calcium caseinate, 6 ounces to 50 gallons of spray.
S. B. = Self-boiled lime-sulphur mixture, 8–8–50.
S. = Sulphur 6 pounds, hydrated lime 8 pounds, calcium caseinate 12 ounces per 50 gallons of spray. (Sulphur, lime, calcium-caseinate mixture.)
S. 1 = Sulphur 3 pounds, hydrated lime 4 pounds, calcium caseinate 6 ounces per 50 gallons of spray. (Sulphur, lime, calcium-caseinate mixture.)
0–5–95 = Dust; arsenate of lead, 5 per cent; hydrated lime, 95 per cent.
80–5–15 = Dust; sulphur, 80 per cent; arsenate of lead, 5 per cent; lime, 15 per cent.
50–5–45 = Dust; sulphur, 50 per cent; arsenate of lead, 5 per cent; lime, 45 per cent.

As in the two years preceding, the experiments for 1923 were duplicated on two varieties of peaches, the Hiley and the Elberta. The orchards used were on sandy loam soil, and the land was generally level. Since the orchards were about one-half mile apart a test of the various treatments was afforded in two different localities. About 2,600 trees, divided for the most part into plats of as nearly 150 trees as practicable, were used in the experiments. (Figs. 7 and 8.) Three plats of each variety, including the check plats, were composed of about 75 trees each. Near the center of each plat 10 trees were selected as record trees, the fruit from which was cut open and examined for injury from the curculio, brown rot, and scab. All "drops" from these record trees were collected at intervals, and examinations made for data on the curculio infestation. In the season of 1923, 68,746 peaches were cut open to obtain data from which to draw conclusions.

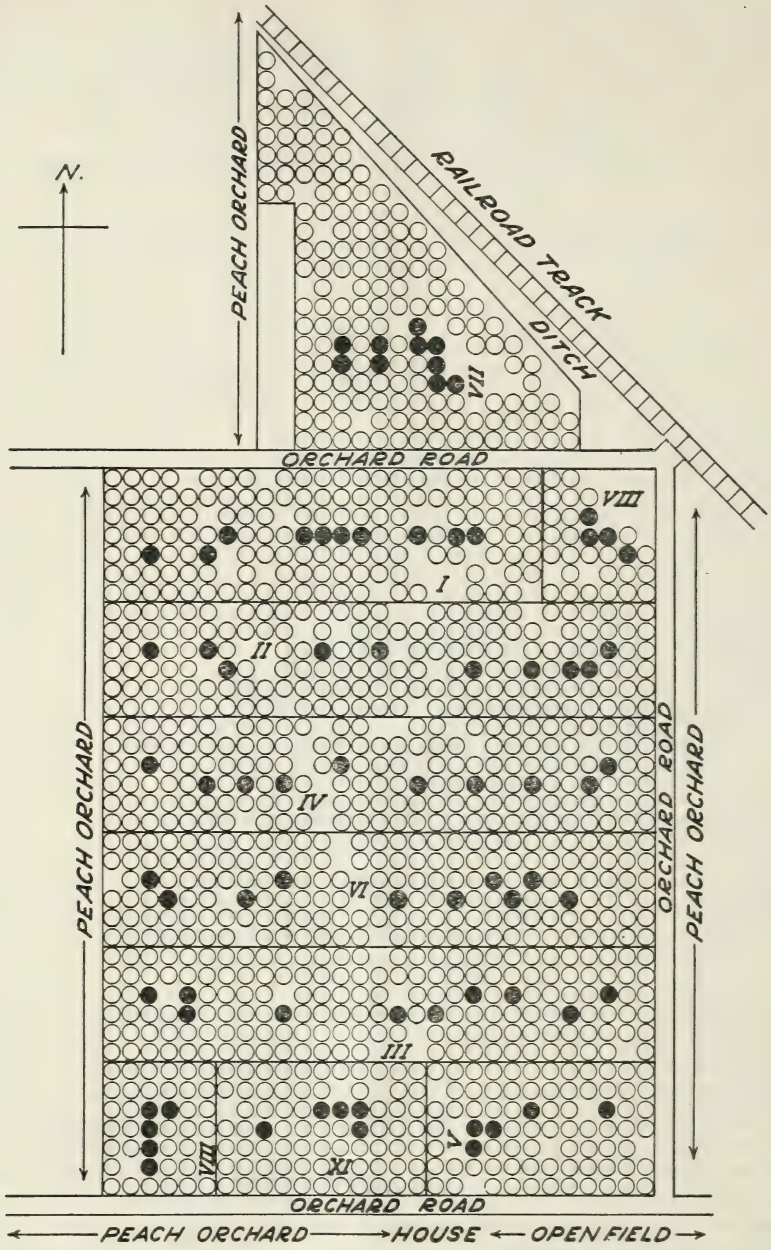

FIG. 7.—Diagram of orchard of Hiley peaches, used for experiments in the season of 1923. Each tree is represented by a circle, the solid black circles representing record trees

No data on curculio control were taken for the fruit from Plat VII, as the arsenate-of-lead treatments on this plat were the same as those on Plat VI. The dust schedule used on Plat VII was used for testing the effectiveness of a low percentage of sulphur for control of brown rot and scab.

All applications of liquid and dust made in the season of 1923 were applied with large power spraying and dusting machines. This, and all other operations in 1923, were performed by the writers.

Tables 8, 9, and 10 present the results, in percentages, of the experiments in spraying and dusting conducted on the Hiley variety during

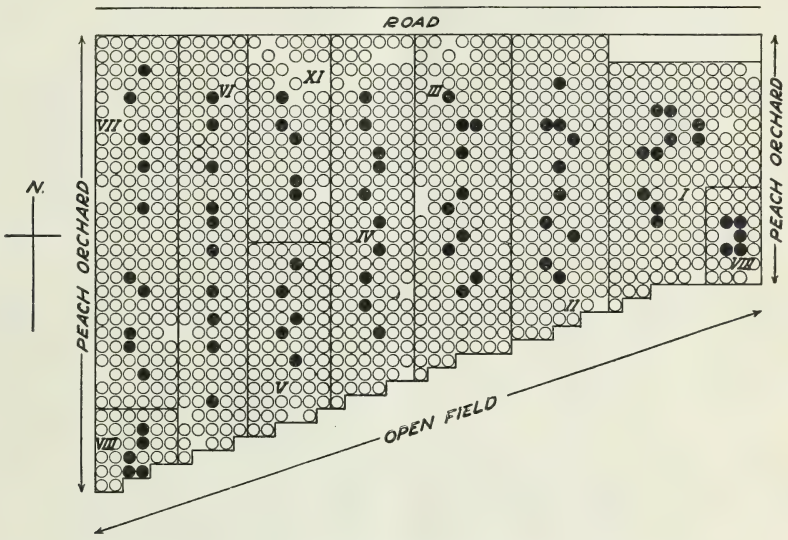

FIG. 8.—Diagram of orchard of Elberta peaches, used for experiments in the season of 1923. Each tree is represented by a circle, the solid black circles representing record trees

the season of 1923. Table 8 presents the data obtained from cutting open the fruit harvested from the record trees of each plat. The apparent discrepancies between "sound fruit" and "merchantable fruit" in this table were due to the fact that many peaches containing only a few scab spots were allowed by the graders to pass as merchantable fruit. Table 9 contains the percentages of curculio-wormy fruit that dropped to the ground from the record trees at various times before harvest, and Table 10 presents the commercial results, in merchantable and cull fruit, from all the trees in each plat.

TABLE 8.—*Summary of results of experiments in peach dusting and spraying at Fort Valley, Ga., in 1923; fruit harvested from record trees of the Hiley variety*

Plat	Total number of fruit	Percentage of total fruit having—												Percentage of total fruit found to be sound	Percentage of total fruit as graded before being opened for examination	
		Curculio	Brown rot	Scab	Curculio larvæ only	Brown rot only	Scab only	Curculio larvæ and—			Brown rot and scab	Brown-rot infection at curculio puncture	Scab and brown-rot infection at curculio puncture		Merchantable fruit	Cull fruit
								Brown rot and scab	Brown rot	Scab						
I	2,861	0.9	5.8	18.6	0.6	3.1	16.1				2.4	0.2	0.1	77.5	90.8	9.2
II	3,333	1.3	1.8	20.4	.8	1.1	19.4			0.3	.5	.2		77.7	93.2	6.8
III	4,585	1.5	2.7	7.7	1.2	2.1	7.0			.2	.5	.1		88.9	93.5	6.5
IV	3,936	1.8	3.0	14.0	1.4	2.1	13.2			.1	.6	.2	.1	82.3	93.7	6.3
V	1,023	.6	2.2	7.0	.4	1.6	6.4			.1	.5	.1		90.9	94.7	5.3
VI	4,813	1.5	10.2	17.8	1.0	7.4	15.0			.2	2.5	.2	.1	73.6	88.3	11.7
VII [1]	3,709		6.8	23.0		5.4	21.6				1.4			71.6	91.9	8.1
VIII [2]	4,194	6.4	30.6	92.5	.2	4.4	63.8	0.2		3.0	23.0	.5	2.5	2.4	56.0	44.0
IX	880	3.6	2.3	7.5	2.9	1.9	6.9	.1		.4	.1	.2		87.5	90.3	9.7

[1] No records on curculio infestation taken for this plat. [2] Check plat; not sprayed or dusted.

TABLE 9.—*Number of peaches dropping from Hiley peach trees and percentage of them infested by curculio in experimental orchards at Fort Valley, Ga., 1923*

Plat	Total number of drops	Total percentage of drops infested by curculio
I	1,304	9.4
II	1,467	13.2
III	1,922	16.3
IV	1,493	13.1
V	644	33.1
VI	2,933	15.8
VIII	2,637	35.9
IX	444	8.8

TABLE 10.—*Commercial results of fruit from all trees in each plat of the Hiley variety used in the peach-spraying and dusting experiments, Fort Valley, Ga., 1923*

Plat	Number of trees in plat	Average merchantable fruit per tree (expressed in cups; six cups equal one crate)	Average cull fruit per tree (expressed in cups; six cups equal one crate)
I	141	8.90	0.95
II	158	10.85	.85
III	165	14.35	.95
IV	159	13.25	.90
V [1]	77	7.20	.40
VI	166	14.30	1.90
VII [2]	157	11.30	.95
VIII [3]	68	7.05	5.50
IX [1]	73	5.60	.50

[1] Light crop in 1923 because of severe defoliation in 1922 from the mixture of sulphur, lime, calcium caseinate, and arsenate of lead mentioned on p. 10.
[2] Fruit damaged by curculio not graded out on this plat.
[3] In two portions, in opposite corners of the orchard.

Life-history studies showed that in the season of 1923 there was only one generation of the curculio at Fort Valley, Ga. Similar studies had shown two complete generations in the season of 1921 and again in that of 1922. Since there was only one generation in 1923, the early applications of arsenate of lead did not have a chance to prove their effectiveness against a second brood of larvæ. Therefore, as shown in Table 8, there was little difference between the number of the curculio-infested peaches from the plats that received the early spray and those that were not sprayed until the calyces, or "shucks," were shedding. Since there is no way to predict accurately early in the season whether two generations of the curculio will occur, or only one, peach growers could not afford to omit the early arsenate-of-lead treatment, as this materially reduces the size of the second brood of "worms" in years when two generations occur.

In 1923 the curculio infestation in the experimental orchard of Hiley peaches was light, as only 6.4 per cent of the fruit harvested from the check, or untreated, plat was "wormy." The spray schedule recommended to the growers, which was the one used in treating Plat I, gave the best control of the curculio.

The control of the curculio, as shown by the percentage of infestation in the harvested fruits, was not quite so good in Plat III, which received four applications of arsenate of lead in the proportion of three-fourths of a pound to 50 gallons of spray, as in Plat I, which received three applications in the proportion of 1 pound of arsenate of lead to 50 gallons of spray. (Tables 8 and 9.) Moreover, the four applications of the less poisonous spray were otherwise less desirable than three applications of the stronger, because of the greater injury which the former inflicted on the foliage.

Three applications of self-boiled lime-sulphur gave slightly better control of brown rot (Table 8, Plat III) than two applications. The control of scab was also somewhat better from the three applications. Since in previous years it had been found unnecessary to make an application for the control of scab earlier than about four weeks after the falling of the petals, it is probable that if in the plats receiving two applications of the fungicide the first application had been made slightly earlier, control would have been as good as in the plat receiving three applications. The addition of calcium caseinate did not increase the effectiveness of the arsenate of lead used for controlling the curculio in either the "drops" or the harvested fruit. The plat receiving the regular treatments but with the addition of calcium caseinate to all sprays yielded harvested fruit with a smaller percentage of brown rot (Table 8, Plat II), but the scab on this plat was heavier. The differences, however, were too small to be significant.

The two different mixtures of sulphur, hydrated lime, and calcium caseinate used on Plats V and IX gave very satisfactory control of brown rot and scab, but there was more burning of the foliage in these two plats than in any other plat in the orchard. While this burning was not nearly so severe as that obtained from the mixture used in 1922, it was too serious to warrant an unqualified recommendation of the mixture for use in the South. It should be noted, however, that arsenate of lead was used with it in both applications. The spray continued to give better control of curculio and brown rot

than the dust, as recorded in Table 8 for Plats I and VII. The 50 per cent sulphur dust used on Plat VII gave a somewhat better control of brown rot than the 80 per cent sulphur dust used on Plat VI, but not nearly so good control of scab.

Scab was quite prevalent in this orchard in 1923. The fruit harvested from the check plat was 92.5 per cent scabby, although the individual fruits were not so severely attacked as in northern orchards. Brown rot was moderately severe, as indicated by 30.6 per cent of rotten fruit from the check plat.

Tables 11, 12, and 13 give, in percentages, the results of the experiments in spraying and dusting conducted on the Elberta variety during the season of 1923. Table 11 gives the data obtained from the examination of the fruit harvested from the record trees, Table 12 the percentages of curculio infestation of the "drops" from the record trees in each plat, and Table 13 brings together the commercial results, in merchantable and cull fruit, from all the trees in each plat.

TABLE 11.—*Summary of results of experiments in peach dusting and spraying at Fort Valley, Ga., in 1923; fruit harvested from record trees of the Elberta variety*

Plat	Total number of fruit	Percentage of total fruit having—												Percentage of total fruit found to be sound	Percentage of total fruit as graded before being opened for examination	
		Curculio	Brown rot	Scab	Curculio larvæ only	Brown rot only	Scab only	Curculio larvæ and—			Brown rot and scab	Brown-rot infection at curculio puncture	Scab and brown-rot infection at curculio puncture		Merchantable fruit	Cull fruit
								Brown rot and scab	Brown rot	Scab						
I	1,827	6.1	1.0	8.6	5.1	1.0	7.6			1.0				85.3	91.7	8.3
II	1,661	4.7	1.5	10.0	4.1	1.2	9.5			.4	0.1	0.2		84.5	91.0	9.0
III	1,354	8.1	1.0	6.0	7.0	.9	4.8			1.1	.1			86.1	90.8	9.2
IV	1,164	7.0	2.5	13.9	5.7	1.5	12.2			1.0	.7	.3		78.6	89.3	10.7
V	630	3.0	3.8	7.0	2.7	2.5	6.0				1.0	.3		87.5	90.3	9.7
VI	912	16.2	3.4	24.5	11.2	1.9	19.0	0.3	0.2	4.2	.7		0.3	62.2	89.1	10.9
VII [1]	1,932		7.3	44.1		4.4	41.2				2.9			51.5	84.0	16.0
VIII [2]	1,407	28.2	11.9	67.0	8.8	3.6	45.8	.6	.9	14.9	3.8	1.1	1.9	18.6	69.1	30.9
IX	580	5.1	1.8	3.1	4.6	1.4	2.6			.3	.2	.2		90.7	88.5	11.5

[1] No records of curculio infestation taken on this plat.
[2] Check plat: Not sprayed or dusted.

TABLE 12.—*Number of peaches dropping from Elberta peach trees, and percentage of those infested by curculio, in experimental orchard at Fort Valley, Ga., 1923*

Plat	Total number of drops	Total percentage of drops infested by curculio
I	2,627	5.2
II	2,368	4.3
III	2,629	2.1
IV	1,269	7.9
V	1,257	8.9
VI	1,650	12.1
VIII	2,367	16.1
IX	934	2.6

TABLE 13.—*Commercial results of fruit from all trees in each plat of the Elberta variety, peach spraying and dusting experiments, Fort Valley, Ga., 1923*

Plat	Number of trees in plat	Average merchantable fruit per tree (expressed in cups; six cups equal one crate)	Average cull fruit per tree (expressed in cups; six cups equal one crate)
I	148	7.65	0.7
II	146	7.15	.7
III	158	5.9	.6
IV	148	4.95	.6
V	77	5.6	.6
VI	145	4.05	.5
VII [1]	155	7.9	1.5
VIII [2]	54	3.8	1.75
IX	79	4.6	.5

[1] Fruit damaged from curculio not graded out on this plat.
[2] In two portions, at opposite ends of the orchard.

The spraying and dusting treatments for controlling the curculio received a much more severe test in the plats of Elberta peaches than in those of the Hiley variety during the season of 1923. Of the fruit harvested from the check (or untreated) plat, 28.2 per cent was infested with curculio larvæ. Scab was more prevalent than is usual in central Georgia, the check plat having an infection of 67 per cent. Brown rot was not so serious; 11.9 per cent of the fruit in the check plat was affected with it.

Owing to the fact that there was but one brood of the curculio in 1923, the value of the early application of arsenate of lead was not so distinctly shown in the curculio infestation of the fruit harvested from the various plats. The early spray did, however, reduce the early infestation by the curculio, as evidenced by examination of the "drops." This reduction would have had a corresponding effect on the reduction of the infestation in the harvested fruit had there been two generations of the curculio. The "drops" from plats IV and V, neither of which received the early application of arsenate of lead, were more heavily infested by curculio than the "drops" from Plats I, II, and III, to all of which the early application was made (Table 12).

The fruit harvested from Plat III, which received four applications of spray containing three-fourths of a pound of arsenate of lead to 50 gallons of water, had an infestation of 8.1 per cent; the infestation of Plat I, which received three applications of spray containing 1 pound of arsenate of lead to 50 gallons of water, was 6.1 per cent. Because of the injury inflicted on the foliage sprayed, the schedule for Plat III is not so safe as the schedule by which Plat I was treated.

Three applications of self-boiled lime-sulphur to Plat III gave no better control of brown rot (see Table 11) than did two applications to Plat I, and the control of scab was practically the same in both cases. The addition of calcium caseinate seemed to cause a slight increase in the effectiveness of the arsenate of lead against the curculio in Plat II, but it did not increase the effectiveness of the fungicide against brown rot or scab.

The two sprays of sulphur, hydrated lime, and calcium caseinate in combination with arsenate of lead, when used on Plats V and IX, gave essentially the same results as their application to the Hiley variety. Good control of both brown rot and scab resulted, but the burning of the foliage was too severe to warrant an unqualified recommendation for its use. The sprays controlled curculio, brown rot, and scab in the experimental orchard of Elberta peaches better than did the dust. Plat VI (Table 11) had a curculio infestation of 16.2 per cent, a brown-rot infection of 3.4 per cent, and a scab infection of 24.5 per cent of the dust schedule, as against corresponding percentages of 6.1, 1.0, and 8.6 for Plat I, sprayed with arsenate of lead.

The dust containing 80 per cent of sulphur, used on Plat VI, gave much better results than the dust containing 50 per cent, used on Plat VII. There was a brown-rot infection of 3.4 per cent, and a scab infection of 24.5 per cent in Plat VI; Plat VII had corresponding percentages of 7.3 and 44.1.

Table 13 shows that the schedule used on Plat I, which was the one recommended to the growers for the season of 1923, resulted in the highest yield of merchantable fruit.

EXPERIMENTS IN 1924

Life-history studies of the curculio have shown that when the adults leave their hibernation late in the spring, and that when, also, the pupation season of the first generation is unusually cool and damp, only one generation occurs annually in Georgia. Spray schedules were therefore included in the program of experiments for 1924, arranged to determine the best method of controlling the curculio when the first application of arsenate of lead is omitted. Such a schedule was checked against the regular schedule involving four treatments, carried out on an adjoining plat. Before the experiments were begun, colloidal sulphur, recommended for the control of brown-rot and scab, had made its appearance on the market. Tests were therefore included to determine the effectiveness and safety of this fungicide, with and without lime. Manufacturers had advised growers to use it without lime. The comparative effectiveness of the recommended dusting and spraying schedules was again tested. To determine the results obtained by keeping the fruit continuously covered with dust until the stage when the peach stone hardens, a plat was included which received after each rain an application of dust in the proportion of 0–5–95, from the falling of the petals until two weeks after the shedding of the calyces; an application of the 80–5–15 dust was then given. The treatment for this plat was concluded with an application four weeks before harvest of spray of arsenate of lead and self-boiled lime-sulphur. A plat was also included at the beginning of the season to test the effectiveness of a 2 per cent nicotine dust against the curculio. This test was abandoned after the second application had been made, as the results, correlated with the the results of feeding tests with nicotine dust in the insectary, had shown that the material was not sufficiently economical and effective to warrant further experimentation.

Table 14 gives in outline the schedules tested in the spraying and dusting experiments in 1924.

TABLE 14.—*Outline of experiments in spraying and dusting peach trees, for the season of 1924, Fort Valley, Ga.*

Plat	Time of application			
	As petals fall	When calyces are shedding	Two weeks after shedding of calyces	Four weeks before harvest
I	A. L.–L	A. L.–L	S. B	A. L.–S. B.
II		A. L.–L	C	A. L.–C.–L.
II [1]		A. L.–L	C	A. L.–C.
III	0–5–95	0–5–95	80–5–15	80–5–15.
IV [2]	0–5–95	0–5–95	80–5–15	A. L.–S. B.
V [3]				

[1] About 20 trees in Plat II were, in the last two applications, treated with colloidal sulphur, without lime.

[2] The dust in the proportion of 0–5–95 was applied after each rain until two weeks after the calyces were shed, when one application of the 80–5–15 dust was made. After the hardening of the stones the treatment for this plat was concluded with an application of arsenate of lead and self-boiled lime-sulphur.

[3] Check plat; not treated.

A. L.=Arsenate of lead powder, 1 pound to 50 gallons of spray.
L.=Milk of lime, made from 3 pounds of stone lime per 50 gallons of spray.
S. B.=Self-boiled lime-sulphur mixture, 8–8–50.
C.=Colloidal sulphur, 5 pounds to 50 gallons of water.
0–5–95=Dust; arsenate of lead, 5 per cent; hydrated lime, 95 per cent.
80–5–15=Dust; sulphur, 80 per cent; arsenate of lead, 5 per cent; hydrated lime, 15 per cent.

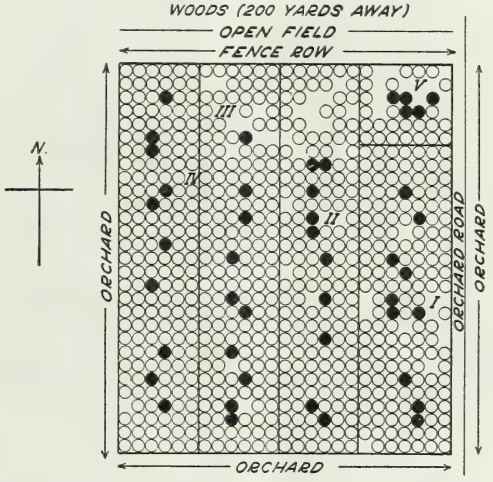

FIG. 9.—Diagram of orchard of Hiley peaches, used for experiments in the season of 1924. Each tree is represented by a circle, the solid black circles representing record trees

As in previous years the experiments in 1924 were duplicated on two of Georgia's most popular varieties—the Hiley and the Elberta. The orchards, which were level and on sandy loam soil, were some 2 or 3 miles from the location of the experiments of the three preceding years, and an opportunity was consequently afforded to test the treatments under conditions of curculio infestation and prevalence of disease in a new location near Fort Valley. The size of the plats treated varied from 150 to 172 trees each. There were 30 check, or untreated, trees in the Hiley orchard, and 35 in the Elberta orchard. (See figs. 9 and 10.) As in the former experiments, 10 trees were selected in the central part of each plat as record trees, the fruit from which was cut open and examined for injury from cur-

culio, brown rot, and scab. All peaches which dropped from these record trees were collected at intervals and examined for data relating to the curculio infestation. In the season of 1924, 135,967 peaches were cut open to obtain data for study. All the spraying and dusting were done with large power machines. The same spray men conducted the work throughout the season.

Tables 15, 16, and 17 present the results, in terms of percentages, of the experiments conducted on the Hiley peaches in 1924. Table 15 presents the data obtained from cutting open the fruit harvested from the record trees of each plat, Table 16 the percentages of curculio-infested fruit that dropped to the ground from the record trees in each plat before harvest, and Table 17 the commercial results in merchantable and cull fruit from all the trees in each plat.

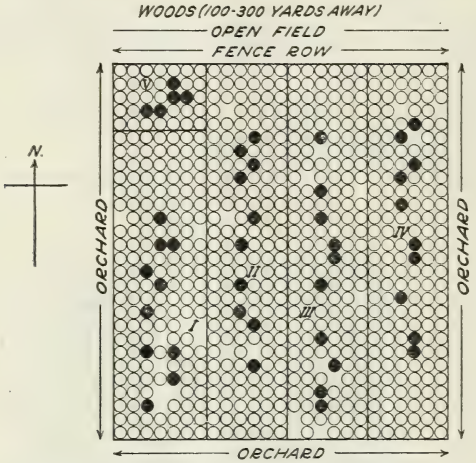

FIG. 10.—Diagram of orchard of Elberta peaches, used for experiments in the season of 1924. Each tree is represented by a circle, the solid black circles representing record trees

TABLE 15.—*Summary of results of experiments in peach dusting and spraying at Fort Valley, Ga., in 1924; fruit harvested from record trees of the Hiley variety*

Plat	Total number of fruit	Percentage of total fruit having—												Percentage of total fruit found to be sound	Percentage of total fruit as graded before being opened for examination	
		Curculio	Brown rot	Scab	Curculio larvæ only	Brown rot only	Scab only	Curculio larvæ and—			Brown rot and scab	Brown-rot infection at curculio puncture	Scab and brown-rot infection at curculio puncture		Merchantable fruit	Cull fruit
								Brown rot and scab	Brown rot	Scab						
I	8,107	3.9	2.3	8.6	3.3	1.9	8.0	----	0.1	0.4	0.2	0.1	----	86.0	95.4	4.6
II	6,485	1.3	.7	1.7	1.2	.7	1.6	----	----	.1	----	----	----	96.4	96.2	3.8
III	7,409	4.6	1.6	9.1	3.9	1.3	8.3	----	----	.6	.2	.1	----	85.6	96.4	3.6
IV	9,042	2.8	1.6	3.7	2.6	1.5	3.6	----	----	.1	----	.1	----	92.1	95.7	4.3
V [1]	4,233	10.5	16.1	71.5	2.0	5.1	55.5	0.4	.3	6.0	8.5	.7	1.1	20.4	77.9	22.1

[1] Check plat; not sprayed or dusted.

TABLE 16.—*Number of peaches dropping from Hiley peach trees, and percentage of them infested by the curculio, in experimental orchard at Fort Valley, Ga., 1924*

Plat	Total number of drops	Total percentage of drops infested by curculio
I	10,558	1.5
II	6,692	2.1
III	7,520	1.4
IV	8,202	3.2
V	6,072	22.5

TABLE 17.—*Commercial results of fruit from all trees in each plat of the Hiley variety, peach spraying and dusting experiments, Fort Valley, Ga., 1924*

Plat	Number of trees in plat	Average merchantable fruit per tree (expressed in cups; six cups equal one crate	Average cull fruit per tree (expressed in cups; six cups equal one crate)
I	150	20.00	0.95
II	158	15.40	.60
III	162	18.80	.70
IV	172	22.10	1.00
V	30	16.20	4.60

The winter of 1923–24 was unusually cold. At one time the temperature dropped to a minimum of 7° above zero at Fort Valley. As a result of the abnormal weather many adult curculios were undoubtedly killed in hibernation. It was found that only 11.5 per cent of the beetles that went into leaves for hibernating quarters in the fall of 1923 appeared during the spring of 1924, as compared with an appearance of 63.2 per cent from the same conditions of hibernation in the spring of 1923. The spring of 1924 was unusually cool and late, and the beetles that did survive the winter were rather late in leaving hibernation. As a result, the Hiley peaches suffered only a light infestation of the curculio. The infestation in the fruit harvested from the check, or untreated, plat of this variety was only 10.5 per cent, and the infestation in the "drops" from the same plat was only 22.5 per cent. The schedules had therefore a very mild test against the curculio in the Hiley orchard, and because the beetles were scarce at the beginning of the season of 1924 the early treatments with arsenate of lead had little chance to prove their effectiveness. As the season progressed the weather became very hot, and by midsummer there were some abnormally high temperatures and frequent rains. As a result, the development of the curculio was accelerated; two broods of the insect were produced in the season, although the overwintering adults left hibernation late in the spring. By the time the Elberta peaches were ready to be harvested the curculio population had materially increased in the orchards. All treatments were much more severely tested in the Elberta experimental orchard than in the orchard of the Hiley variety.

In the Hiley orchard infection by scab was heavier than is usual in central Georgia, as indicated by an infection of 71.5 per cent in the check plat. Of the fruit harvested from the check plat in the Hiley orchard 16.1 per cent had brown rot. This moderately light infection was to be expected because of the light infestation of the curculio. Such an infestation is generally reflected in the degree of brown rot, as there is a close interrelation between the injuries caused by the two pests.

Because of the very light infestation of the curculio at the beginning of the season, no data of value were obtained on the control of the insect in the Hiley orchard. According to Table 16 the "drops" from Plat II, which did not receive the early treatment with arsenate of lead, suffered an infestation of 2.1 per cent. A curculio infestation of 1.5 per cent was found in the "drops" from Plat I, which received the first arsenical treatment as the petals fell. There was little difference between the curculio infestations of the "drops" from the plats receiving the spray and those from the plats treated with dust. The "drops" from Plat I, sprayed with liquid, suffered a curculio infestation of 1.5 per cent, whereas those from the two plats receiving dust suffered infestations of 1.4 and 3.2 per cent, respectively.

Colloidal sulphur gave good control of brown rot and scab, as indicated by 0.7 per cent brown rot and 1.7 per cent scab (Table 15, Plat II). This material in combination with arsenate of lead, without lime, produced very severe burning of the foliage, resulting in almost complete defoliation shortly after the harvest. When lime is used with the colloidal sulphur in combination with arsenate of lead, the burning is materially reduced.

Plat III, which received the recommended dust schedule, suffered a curculio infestation of 4.6 per cent, a brown-rot infection of 1.6 per cent, and a scab infection of 9.1 per cent. Plat I, which received the recommended spray schedule, had a curculio infestation of 3.3 per cent, a brown-rot infection of 2.3 per cent, and a scab infection of 8.6 per cent. Judging from the data of other years, this difference would undoubtedly have been much greater had the curculio infestation and brown-rot infection been heavy.

Plat IV, which was given a dusting after every rain until the peach stones began to harden, and which was finally sprayed, manifested about the same control of the curculio as did Plat I, which received the regular spray treatments.

It is seen from Table 17 that Plat IV, which received a treatment of both dust and liquid, and Plat I, which received the recommended treatment with spray, bore more merchantable fruit per tree than the other plats.

Tables 18, 19, and 20 present, in percentages, the results of the experiments in spraying and dusting on the Elberta peaches in 1924. Table 18 presents the data for the fruit harvested from the record trees, Table 19 the percentages of curculio-infested fruit that dropped to the ground from the record trees in the several plats before harvest, and Table 20 the commercial results in merchantable and cull fruit from all the trees in each plat. The apparent discrepancies between "sound fruit" and "merchantable fruit" in Table 18 were due to the fact that some peaches containing a few scab spots were graded as merchantable fruit.

TABLE 18.—*Summary of results of experiments in peach dusting and spraying at Fort Valley, Ga., in 1924; fruit harvested from record trees of the Elberta variety*

Plat	Total number of fruit	Percentage of total fruit having—												Percentage of total fruit found to be sound	Percentage of total fruit as graded before being opened for examination	
		Curculio larvæ	Brown rot	Scab	Curculio larvæ and—						Brown rot and scab	Brown-rot infection at curculio puncture	Scab and brown-rot infection at curculio puncture		Merchantable fruit	Cull fruit
					Curculio larvæ only	Brown rot only	Scab only	Brown rot and scab	Brown rot	Scab						
I	6,329	21.9	6.9	23.3	13.4	4.7	14.2	0.1	0.3	7.6	1.3	0.4	0.1	57.9	83.0	17.0
II	7,238	28.5	5.1	39.0	13.0	1.7	22.8	.5	.5	13.6	1.5	.3	.6	45.5	81.0	19.0
III	5,636	30.7	8.4	44.9	13.7	3.1	26.3	.8	.4	14.3	2.6	.6	.9	37.3	78.8	21.2
IV	6,316	24.4	3.5	38.2	12.2	1.2	25.1	.2	.1	11.2	1.3	.4	.3	48.0	86.3	13.7
V [1]	4,163	54.1	30.3	89.7	1.9	3.5	27.9	4.0	.6	37.0	11.6	1.4	9.2	2.9	------	100.0

[1] Check plat; not sprayed or dusted.

TABLE 19.—*Number of peaches dropping from Elberta peach trees and percentage of them infested by curculio in experimental orchard at Fort Valley, Ga., 1924*

Plat	Total number of drops	Total percentage of drops infested by curculio
I	6,596	6.2
II	6,812	13.0
III	6,823	8.5
IV	6,872	8.4
V	4,862	64.8

TABLE 20.—*Commercial results of fruit from all trees in each plat of the Elberta variety, peach spraying and dusting experiments, Fort Valley, Ga., 1924*

Plat	Number of trees in plat	Average merchantable fruit per tree (expressed in cups; 6 cups equal 1 crate)	Average cull fruit per tree (expressed in cups; 6 cups equal 1 crate)
I	151	17.6	3.7
II	163	21.3	5.0
III	158	16.4	4.4
IV	164	18.9	3.0
V	35	------	25.2

As stated in the discussion of the results with Hiley peaches in 1924, unusually high temperatures prevailed in Georgia just before the harvest of Elberta peaches. These, accompanied by almost daily showers, greatly hastened and facilitated the development of the first generation of adult curculios and the production of a second brood. The check, or untreated, plat in the Elberta experimental

orchard suffered the heavy curculio infestation of 54.1 per cent for the harvested fruit and 64.8 per cent for the "drops." This is the heaviest infestation of the curculio in any orchard of those in which were tested the spraying and dusting schedules considered in this publication. The difference between the curculio infestations of the "drops" in the Hiley and Elberta orchards is in all probability due to the fact that because of a late spring the beetles did not begin to appear from hibernation in numbers until after the calyces of the Hiley peaches had begun to dry. This would cause them to seek the Elberta calyces for feeding purposes, as these remain green later than do those of the Hiley variety. The occurrence of first-generation adults in the orchards just before the harvest of Elberta peaches, in addition to the few adults surviving the preceding winter, caused the infestation of the Elberta peaches to be greater at harvest time than that of the other variety. The frequent rains also greatly promoted the development of brown rot and scab in the Elberta orchard, as indicated by a brown-rot infection of 30.3 per cent, and a scab infection of 89.7 per cent, in the check plat. All of the treatments with spraying and dusting were therefore tested much more severely on the Elberta peaches than on the Hileys. The severity of the test to which the treatments were put can be realized by noting the proportion of sound fruit harvested from Plat V, which received no treatment at any time in the season. In Table 18 it may be seen that this, the check plat, produced only 2.9 per cent of sound fruit at harvest, the remaining 97.1 per cent being damaged by the curculio, brown rot, or scab.

In interpreting the results of this work it must be kept clearly in mind that the efficiency of the early application of arsenate of lead must be judged largely from the table giving data on the infestation of the "drops," as the early arsenical treatment is applied especially for the control of the curculio in the "drops" and has a bearing on the control of the insect from the time of application until the fruit is harvested. The efficiency of the late application of arsenate of lead can be measured only from tables giving results in harvested fruit, as practically all "drops" have fallen before this application is given.

The value of the arsenate of lead spray applied just as soon as the petals are down, especially in years when the curculio infestation is heavy, is again clearly demonstrated by the results of the experiments on Elberta peaches. Table 19 shows that of the "drops" from Plat II, which did not receive the early arsenate of lead spray, 13.0 per cent were infested with the curculio, whereas in the case of Plat I, which received the early treatment, only 6.2 per cent of the "drops" were infested. Again, the treatment of Plat I with arsenate of lead when 75 per cent of the petals had fallen reduced the curculio infestation of the "drops" a little over 50 per cent. A reduction of the infestation in the "drops" has a corresponding effect on the infestation in the harvested fruit, as revealed in Table 18. Of the fruit harvested from Plat II, which did not receive the early spray of arsenate of lead, 28.5 per cent was wormy, whereas there was an infestation of 21.9 per cent in the case of Plat I, which was treated with that spray.

The curculio infestation of the "drops" from Plat III, which was dusted on each occasion for treatment, was 8.5 per cent (Table 19),

whereas the "drops" of Plat I, which was sprayed according to schedule, had an infestation of 6.2 per cent (Table 19). The infestation of the "drops" was not lowered by an application of dust after each rain, as Plat IV, treated in that manner, had an infestation of 8.4 per cent, whereas Plat III, which was dusted at the several times specified, suffered an infestation of 8.5 per cent (Table 19).

The spray continued to show its superiority over the dust for curculio, brown-rot, and scab control. Of the fruit harvested from Plat III, which was dusted according to the recommended schedule, 30.7 per cent was "wormy," 8.4 per cent rotten, and 44.9 per cent scabby; whereas of the fruit harvested from Plat I, which was sprayed according to the recommended spray schedule, 21.9 per cent was "wormy," 6.9 per cent rotten, and 23.3 per cent scabby. The control in all of the treated plats of Elberta peaches can not be called excellent, but in interpreting the results one must first consider the very severe test to which all treatments were put. The value of spraying is clearly demonstrated in the work, however, by comparing in Table 18 the data for Plats I and V. Spraying increased the harvested sound fruit 55 per cent on Plat I, as compared with Plat V, which was untreated.

The two applications of self-boiled lime-sulphur to Plat I gave good control of brown rot and scab, considering the weather conditions and the severity of the test. For this plat the infection of brown rot was 6.9 per cent and that of scab 23.3 per cent, whereas for the check plat the infection of brown rot was 30.3 and that of scab 89.7 per cent (Table 18). Colloidal sulphur, applied to Plat II, again gave good control of brown rot, and fair control of scab (Table 18), but in the treatment of the Hiley peaches such serious defoliation had resulted from the use of this material in combination with arsenate of lead without lime that lime was added to each application in which the combination was used on the Elberta peach trees. The addition of lime reduced the severity of the injury, but did not completely eliminate it.

Plat IV, which received an application of dust after each rain until two weeks after the shedding of the calyces, did not control the curculio quite so well as the spray applied to Plat I at the specific times recommended, but gave better control than the four applications of dust to Plat III. The infestation of Plat IV was 24.4 per cent (Table 18), and the infestations of Plats I and III 21.9 and 30.7 per cent, respectively.

From Table 20 it may be seen that no merchantable fruit was harvested from Plat V, untreated. Plat IV, treated with both dust and spray, and Plat I, sprayed according to the recommended schedule, bore the minimum of cull fruit.

CONCLUSIONS

The following conclusions are drawn from the results of the experiments in spraying and dusting peaches, conducted for four years and reported upon in this bulletin. A numerical summary of these results is presented in Table 21.

An application of arsenate of lead, when 75 per cent of the petals have fallen, materially reduces the curculio infestation in the small peaches that drop to the ground before maturing. In seasons in

which there are two generations of the curculio this treatment has a substantial effect in reducing the infestation in the peaches harvested. The importance of this application is apt to be overlooked by the grower who is not inclined to insure his crops early in the season against attacks of pests.

An application of arsenate of lead, made four weeks before mid-season or late varieties of peaches are due to ripen, is indispensable if the curculio is to be satisfactorily dealt with in the South, where two generations of the insect frequently occur.

Arsenate of lead, used at the rate of three-quarters of a pound to each 50 gallons of water, is not so effective against the curculio as when used at the rate of 1 pound to each 50 gallons of water.

The insecticidal action of triplumbic arsenate of lead is too slow for best results in controlling the curculio. The diplumbic arsenate should always be used (experiments in 1921).

The addition of calcium caseinate did not increase the effectiveness of arsenate of lead or that of self-boiled lime-sulphur in controlling the pests that attack the peach fruit.

The mixture of sulphur, hydrated lime, and calcium caseinate, tested in combination with arsenate of lead, gave good results in controlling brown rot and scab, but under the conditions prevailing in central Georgia the mixtures tested resulted in injury to the foliage sprayed. This is especially true of the mixture used in 1922, which at an abnormally early date caused complete defoliation.

TABLE 21.—*Summary of results, in 1921 to 1924, of using the standard schedules for spraying and dusting recommended to peach growers*

FROM HILEY PEACHES

Year	Treated with standard spray					Treated with standard dust					Untreated				
		Per cent of total fruit—					Per cent of total fruit—					Per cent of total fruit—			
	Plat No.	Infested with curculio larvæ	Infected with brown rot	Infected with scab	Sound	Plat No.	Infested with curculio larvæ	Infected with brown rot	Infected with scab	Sound	Plat No.	Infested with curculio larvæ	Infected with brown rot	Infected with scab	Sound
1921	II	6.9	3.2	.....	90.5	X	18.1	2.9	.....	79.8	XII	40.8	4.9	.....	57.2
1922	I	1.8	1.1	0.8	96.5	VI	11.3	5.2	0.9	84.5	VII	22.9	32.0	64.9	13.9
1923	I	.9	5.8	18.6	77.5	VI	1.5	10.2	17.8	73.6	VIII	6.4	30.6	92.5	2.4
1924	I	3.9	2.3	8.6	86.0	III	4.6	1.6	9.1	85.6	V	10.5	16.1	71.5	20.4

FROM ELBERTA PEACHES

1921	II	28.3	35.9	3.4	44.1	X	54.9	55.8	2.2	16.2	XII	45.4	77.8	45.6	4.0
1922[1]															
1923	I	6.1	1.0	8.6	85.3	VI	16.2	3.4	24.5	62.2	VIII	28.2	11.9	67.0	18.6
1924	I	21.9	6.9	23.3	57.9	III	30.7	8.4	44.9	37.3	V	54.1	30.3	89.7	2.9

[1] The total number of Elberta peaches harvested in 1922 on the count trees was 3,802, or an average of 54.3 peaches for each of the 70 count trees. The total number of Hiley peaches harvested in the same year on the 70 count trees was 65,534, or an average of 936.2 per tree, this average being 17 times as great as that for the Elberta peaches.

Colloidal sulphur also gave good results in controlling brown rot and scab, but when this material is used with arsenate of lead lime must be added or severe burning will result. In these experiments

even when lime was added the combination has a tendency to burn more than properly prepared self-boiled lime-sulphur.

The results gained from three applications of self-boiled lime-sulphur were not enough better than those from the usual two applications to warrant the extra application.

In each of the four years of the experiments the spray was more effective than the dust against the curculio, brown rot, and scab.

Although the schedule which combined dust and spray, and provided for an application of dust after each rain until the hardening of the peach stones, was more effective against the curculio than the schedule providing for applications of dust at specified times, it was not so effective as the schedule for applications of spray at specified times.

Dust containing 10 per cent of arsenate of lead gave no better control of the curculio than did the dust containing only 5 per cent, and resulted in more burning of the foliage.

Dust containing only 50 per cent of sulphur did not control brown rot and scab so well as one containing 80 per cent.

A dust composed of 80 per cent of sulphur and 20 per cent of lime, when applied 7 to 10 days before harvest as an auxiliary to the usual spray, did not diminish infections of brown rot and scab, but nevertheless might be desirable in very moist seasons.

RECOMMENDATIONS FOR SPRAYING AND DUSTING

The following schedules for spraying and dusting are formulated from the results reported in this bulletin, and are recommended for future use in the South, where two broods of the curculio frequently occur.

SPRAYING SCHEDULE

FIRST APPLICATION

When 75 per cent of the petals (pink part of flower) have fallen: One pound powdered arsenate of lead, plus enough milk of lime (made from three pounds of stone lime to each 50 gallons of water) to make 50 gallons of spray mixture.

SECOND APPLICATION

When calyces or "shucks" are falling or when small peaches are exposed (this usually occurs about 10 days after the falling of the petals): Spray mixture made as for the first application.

THIRD APPLICATION

Two weeks after the second application, or about four weeks after the petals have been shed: Self-boiled lime-sulphur, 8–8–50, alone. (No arsenate of lead in this application.)

FOURTH APPLICATION

Four weeks before the peaches are due to ripen: One pound powdered arsenate of lead to each 50 gallons of 8–8–50 self-boiled lime-sulphur.

Should a grower fail to make the first application recommended, he should use arsenate of lead in the third application with the self-boiled lime-sulphur; but this should never be done unless, for an unavoidable reason, the first spray could not be applied, Because of the risk of injury, arsenate of lead should not be used in all four applications of the above schedule.

EARLY PEACHES

Early peaches should be sprayed three times. Use the materials recommended for the first, second, and fourth applications, applying them at the times already prescribed. For added protection against brown rot in early varieties, self-boiled lime-sulphur should also be used in the second application.

DUSTING SCHEDULE

FIRST APPLICATION

When 75 per cent of the petals (pink part of flower) have fallen: Arsenate of lead 5 per cent, lime 95 per cent.[5]

SECOND APPLICATION

When calyces or "shucks" are falling, or when small peaches are exposed (this usually occurs about 10 days after the falling of the petals): Arsenate of lead 5 per cent, lime 95 per cent.[5]

THIRD APPLICATION

Two weeks after the second application, or about four weeks after the petals have been shed: Sulphur 80 per cent, arsenate of lead 5 per cent, lime 15 per cent.

FOURTH APPLICATION

Four weeks before the peaches are due to ripen: Sulphur 80 per cent, arsenate of lead 5 per cent, lime 15 per cent.

An additional application of a dust composed of sulphur only or preferably sulphur 80 per cent and lime 20 per cent seven to ten days before the fruit ripens may furnish additional protection against brown rot.

EARLY PEACHES

Early varieties need dusting only three times, using the mixture containing arsenate of lead and lime at the time indicated for the first dusting, and the mixture containing sulphur at the time indicated for the second and fourth dustings.

LITERATURE CITED

(1) Chase, W. W.
1916. The principal parasites of the peach. Ga. State Bd. Ent. Bul. 43: 5–39, illus.

(2) ———
1920. Experimental dusting and spraying of peaches for 1919. Ga. State Bd. Ent. Circ. 30, 13 p.

(3) Quaintance, A. L.
1900. The brown rot of peaches, plums and other fruits. Ga. Agr. Expt. Sta. Bul. 50: 237–269, illus.

(4) ——— and Jenne, E. L.
1912. The plum curculio. U. S. Dept. Agr., Bur. Ent. Bul. 103, 250 p., illus.

(5) Scott, W. M., and Ayres, T. W.
1910. The control of peach brown rot and scab. U. S. Dept. Agr., Bur. Plant Indus. Bul. 174, 31 p., illus.

(6) ——— and Quaintance, A. L.
1911. Spraying peaches for the control of brown rot, scab, and curculio. U. S. Dept. Agr. Farmers' Bul. 440, 40 p., illus.

(7) Snapp, O. I., Turner, W. F., and Roberts, J. W.
1922. Controlling the curculio, brown rot, and scab in the peach belt of Georgia. U. S. Dept. Agr. Circ. 216, 30 p., illus.

(8) United States Department of Agriculture, Weather Bureau.
1921–24. Climatological data, Georgia section . . . February to October, 1921, 1922, 1923, and 1924. Atlanta, Ga.

(9) ———
1926. Summary of the climatological data for the United States by sections. Central and eastern Georgia. U. S. Dept. Agr., Weather Bur. Bul. W, ed. 2, v. 3, illus. (Reprint Sec. 86.)

[5] It is not necessary to use sulphur in the first and second applications, although the regular 80–5–15 dust may be used if desired.